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DESAIN PROPORTIONAL-INTEGRAL OBSERVER UNTUK OPTIMASI METODE COLOUMB COUNTING
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ABSTRACT

Critical production of carbon emission, compels renewable energy application for transportation which one of them is the use of electric vehicle. However, the majority of current electric vehicles still depend on batteries that require the Battery Management System (BMS). One of the important key issues in battery management system design is the accuracy of state of charge (SoC) estimation. A mistake in SoC measurement within BMS can yield the misidentification of overcharge and undercharge conditions of a battery. Coloumb counting method, which is the popular method for SoC estimation has a disadvantage in error propagation. In this study, proportional-integral observer is proposed to reduce the error propagation. Proportional-integral observer was designed to decrease the steady state's error in Coloumb counting method.

The simulation test showed, that proportional-integral (PI) observer can significantly reduce error propagation. In some tests with randomized charge/discharge data, found that proportional-integral observer successfully reduces error from 0.088% ~ 4.74% (coulombs counting without proportional-integral observer) to 0.088% ~ 0.067% (added proportional-integral observer). Furthermore, testing with the constant load discharge data, concluded that proportional-integral observer could improve error from 0.041% ~ 152.20% (coulombs counting without proportional-integral observer) to 0.042% ~ 10.66% (added proportional-integral observer).

Keywords : Battery Management System, state of charge, battery model, Proportional-Integral Controller

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INTISARI

Produksi emisi karbon yang mencapai tahap yang mengkhawatirkan meningkatkan tren penggunaan *renewable energy* salah satunya kendaraan listrik. Mayoritas kendaraan listrik masih mengandalkan baterai yang membutuhkan perangkat *Battery Management System (BMS)*. Salah satu isu penting dalam perancangan *Battery Management System* adalah akurasi dalam mengestimasi *state of charge* (*SoC*). Kesalahan dalam pengukuran *SoC* mengakibatkan *BMS* salah mengenali kondisi *overcharge* dan *undercharge*. Metode *coloumb counting* yang paling populer untuk mengestimasi *SoC* mempunyai kelemahan dalam propagasi galat. *Proportional-integral* (*PI*) *observer* diajukan untuk mengurangi propagasi galat. *Proportional-integral* (*PI*) *observer* didesain untuk mengurangi galat pada keadaan tunak pada metode *coloumb counting*.

Pengujian simulasi didapatkan *proportional-integral* (*PI*) *observer* secara signifikan dapat mengurangi propagasi galat. Pada pengujian dengan data *randomized charge/discharge* dapat disimpulkan bahwa *proportional-integral observer* dapat mengkoreksi galat yang semula 0,088 % ~ 4,74% (*coloumb counting*) menjadi 0,088% ~ 0,067% (ditambahkan *proportional-integral observer*). Di sisi lain, pengujian dengan data *constant load discharge* menghasilkan kesimpulan bahwa *proportional-integral observer* dapat mengkoreksi galat yang semula 0,041% ~ 152,20% (*coloumb counting*) menjadi 0,042% ~ 10,66% (ditambahkan *proportional-integral observer*).

Kata kunci – Segmentasi: *Battery Management System, state of charge*, model baterai, kendali *Proportional-Integral*